

CLAIMS:

1. Method for forming a strained Si layer on a substrate (1), comprising:
 - formation of an epitaxial SiGe layer (4) on a monocrystalline Si surface,
 - formation of said strained Si layer by epitaxial growth of said Si layer on top of said epitaxial SiGe layer (4), said Si layer having a strained state due to said epitaxial growth, characterized in that
- 5 said substrate (1) is a Silicon-On-Insulator substrate comprising a support layer (1), a buried silicon dioxide layer (BOX) and a monocrystalline Si surface layer (3), said method further comprising:
 - ion implantation of said Si surface layer (3) and said epitaxial SiGe layer (4) to
- 10 transform said Si surface layer (3) into an amorphous Si layer (3B) and a portion of said epitaxial SiGe layer (4) into an amorphous SiGe layer (5), a further portion of said epitaxial SiGe layer (4) being a remaining monocrystalline SiGe layer (6),
- said amorphous Si layer (3B), said amorphous SiGe layer and said remaining monocrystalline SiGe layer (6) forming a layer stack (3B, 5, 6) on said buried silicon dioxide
- 15 layer (BOX), with said amorphous Si layer (3B) being adjacent to said buried silicon dioxide layer (BOX).
2. Method for forming a strained Si layer on a substrate (1) according to claim 1, characterized in that said method further comprises patterning of said layer stack (3B, 5, 6)
- 20 for forming active parts of a MOSFET structure.
3. Method for forming a strained Si layer on a substrate (1) according to claim 1 or 2, characterized in that said method further comprises:
 - deposition of a silicon dioxide capping layer (SiO₂ cap) on said remaining
- 25 monocrystalline SiGe layer (6);
- bonding of said substrate (1) to a second substrate (10), said second substrate (10) having a silicon dioxide surface layer (11), said silicon dioxide capping layer (SiO₂ cap) on said substrate (1) being face-to-face with said silicon dioxide surface layer (11);

- removing said support layer (1) by etching; and
- removing said buried silicon dioxide layer (BOX) by etching.

4. Method for forming a strained Si layer on a substrate (1) according to claim 1
5 or 2 or 3, characterized in that said method comprises:
- re-crystallizing of said amorphous Si layer (3B) and said amorphous SiGe layer by a solid phase epitaxy (SPE) regrowth process at an interface between said remaining monocrystalline SiGe layer (6) and said amorphous SiGe layer (5),
 - said amorphous Si layer (3B) being transformed into an epitaxial strained Si
10 layer (9; 9B) and said amorphous SiGe layer (6) being transformed into a re-grown crystalline SiGe layer (8; 8B).
5. Method for forming a strained Si layer on a substrate (1) according to claim 4,
characterized in that said method comprises removal of said re-grown crystalline SiGe layer
15 (8B) by etching.
6. Method for forming a strained Si layer on a substrate (1) according to any one
of the preceding claims, characterized in that said strained Si layer (9; 9B) is a gate channel
in a MOSFET structure.
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7. Method for forming a strained Si layer on a substrate (1) according to any one
of the preceding claims, characterized in that an annealing temperature during said solid
phase epitaxy (SPE) regrowth process is substantially below 600 °C.
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8. Method for forming a strained Si layer on a substrate (1) according to any one
of the preceding claims, characterized in that said Si surface layer (3) has a thickness of less
than 10 nm.
9. MOSFET structure comprising source, drain and gate, wherein said gate
30 comprises a gate channel consisting of a strained Si layer (9; 9B); said strained Si layer (9;
9B) being manufactured by a method in accordance with any one of the preceding claims.
10. Semiconductor device comprising at least one MOSFET structure in
accordance with any one of the preceding claims.